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Successful recovery of plant and animal life carried on a 45-hour journey through space by Biosatellite II may provide important clues about how life forms would develop in a weightless environment in space or how radiation might affect future generations.

Wheat seedlings returned to Earth aboard the spacecraft grew as much in less than two days of weightlessness as the same plants normally grow in three days on Earth. This preliminary finding from one of the 13 groups of plants and animals carried by Biosatellite II is important to botanists and zoologists.

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The return of hundreds of thousands of organisms, apparently alive and vigorous after their brief space journey, is expected to reveal important new knowledge about how weightlessness affects living things.

The team of scientists responsible for planning and carrying out Biosatellite II's 13 experiments was able to establish controlled, laboratory conditions in space for the first time. To allow for the differing reproductive cycles in the variety of organisms flown in the spacecraft, botanists and zoologists will have to wait from a month to almost a year before all the results will be available.

In many instances the animal specimens will have to reproduce through a minimum of three generations before the final effects of their two-day space trip become apparent.

The most important single question for Biosatellite II involved learning whether the changes produced in organisms by radiation are slowed or hastened under weightless conditions.

To arrive at the answer, experimenters sent a variety of species of plants and animals into space. While the majority of them have been brought back alive for further observation and tests in Earth laboratories, a select group was halted or "fixed" aboard the spacecraft at various stages of their development. To obtain a meaningful step-by-step series of such fixes on a brief 45-hour flight, organisms with very rapid growth rates were used.

Fixing is performed by treating live organisms with a chemical which halts their development at a pre-planned stage, killing them and preserving them for later analysis. Thus, in the case of the amoeba specimens, they were fixed at one hour after launch, at 24 hours into the flight and shortly before re-entry.

Specimens in other experiments were also arrested in their growth or development according to a pre-planned schedule, determined by their particular growth or life cycles.

Experimenters having the advantage of the earliest indications of the results of their experiments were those dealing with plant life. Other scientists, involved with more complex organisms or those with longer life cycles will have to wait to assemble their data.

Dr. Charles Lyon, Dartmouth College, and Dr. Samuel Johnson of North American Aviation Inc., reported dramatic differences in plant growth under weightless conditions after the first quick look at their plants when the Biosatellite II experiments capsule was opened in Hawaii, Sept. 9.

Dr. Lyon's 75 wheat seedlings, the first plants ever grown in weightlessness, showed characteristics far different from plants grown on the Earth. The roots of the seedlings curved upward toward the shoots of the seedlings and out to the side. In normal wheat seedlings the roots grow downward vertically or at specific angles to the vertical.

Scientists agreed that theoretically plant roots, stems and leaves might well grow differently in weightless environment than on Earth. The Biosatellite II flight was the first demonstration of this fact.

Unusual plant growth has been demonstrated on Earth with a clinostat. This device rotates growing plants slowly with their stems in a horizontal position, causing a continuous variation of the direction from which gravity affects them.

Behavior of the Biosatellite wheat seedlings corresponded closely to those grown in clinostats on Earth with one important difference -- they showed as much growth in 45 hours as Earth-bound specimens achieved in three full days. Three separate experiments involving wheat seedlings were carried.

In another plant experiment, Dr. Johnson flew nine Yolo Wonder pepper plants, demonstrating that orientation of plant leaves also depends on gravity. The leaves of healthy pepper plants normally grow horizontal to the Earth's surface. But after their return from weightlessness the leaves of Dr. Johnson's plants were curved downward, some far enough to touch the stem.

Early indications from the spacecraft experiments appear to demonstrate that plant leaves depend for their orientation on a continuous gravity field acting from a direction usually parallel to the plant's stem.

Scientists expect the Biosatellite experiments to provide new data about living systems at three levels: whole organisms; living cells and tissue, and the biochemical makeup of living cells.

"Quick look" results apparent from preliminary examination of the other spacecraft experiments were evaluated by NASA officials as follows:

Frog Eggs--Dr. John Tremor of NASA's Ames Research Center reported that the first cell division of the 120 fertilized eggs flown took place under Earth gravity because of the launching delay, rendering the experiment only 60 per cent effective. Dr. Tremor said findings appear to confirm data from a similar experiment carried aboard Gemini XII indicating that weightlessness has no obvious effect on cell division in fertilized frog eggs.

Had the Biosatellite flight continued a full three days, the frog eggs would have developed into tadpoles before re-entry. Development through the tadpole stage into full adults will be completed in an Earth laboratory before complete data can be assessed.

Amoeba--Nearly all the amoeba in this experiment survived, with the exception of those fixed at various periods in their development, Dr. Richard Price of Colorado State University said. This organism closely resembles the human white blood cell in structure and function, Dr. Price explained, and seemed well able to maintain its normal form in the weightless state. Chemical analysis and histology (tissue structure) studies of the specimens are in progress.

Adult Vinegar Gnats--Two weeks to three months will be required to gain complete data from this experiment according to Dr. Luolin Browning of Rice University. The 1,000 flies, mostly females, returned in good condition and their reproduction through the third generation will be observed. The female gnats had been mated before their flight. They were placed in a compartment separate from a group of males. Life span for the Drosophila (vinegar gnat) is 80 to 90 days and some of the genetics data from this experiment may require as long as nine months to acquire.

Vinegar Gnat Larvae--The Drosophila larvae are much more sensitive to radiation and other stimuli than the adult and were studied in a separate experiment conducted by Dr. Irwin I. Oster of Bowling Green State University. All 960 of these organisms returned alive. Development through three generations, requiring several weeks, is necessary to gain complete information.

Blue Wild Flowers--The effect of radiation in weightlessness will be studied in the flower buds of 64 plants, all of which appeared the same on reentry as before launch, Dr. Arnold Sparrow of the Brookhaven National Laboratory reported. First results will be apparent four to five days after recovery.

Normally the nodes on the stamen hairs of the bud are blue. Exposure to radiation produces variants which are pink or red. Dr. Sparrow's studies will attempt to learn whether weightlessness heightens or hinders reaction to radiation and whether it induces changes different in kind as well as quantity.

Flour Beetles--Beetles in the pupae stage were irradiated during weightless flight. Dr. John V. Slater of the University of California explained that they will require several weeks to develop into adults. Normally beetles exposed to such radiation display certain wing abnormalities in the adult stage. Such changes normally would occur in the first adult generation, Dr. Slater said. The thousand beetles in this experiment returned from space in good condition.

Parasitic Wasps--Interest in this study is largely in the male wasp, Dr. R. C. Von Borstel of the Oak Ridge National Laboratory explained. Males returning from space will be mated with females retained on Earth to observe the transmission of genetic characteristics in the offspring. This group will be compared with wasps resulting from males and females which both traveled in space.

Orange Bread Mold--This organism was irradiated during weightlessness in its spore stage in an experiment conducted by Dr. Frederic J. DeSerres of the Oak Ridge National Laboratory. The defects anticipated would be imperfections or indentations in the cell walls after development into a fungus stage. Such changes would be apparent as early as the first or second generations. Weeks will be needed to grow out succeeding generations and assess results. The mold cells, totaling 500 million were returned in good condition.

Lysogenic Bacteria--The greatly multiplied group of bacteria was rushed from Hawaii to mainland laboratories for study, since all data from this experiment had to be obtained within 36 hours of the capsule opening. Reproduction of the organism multiplied them rapidly. For every 10,000 cells launched, one billion were returned. Dr. Rudolph H. T. Mattoni of the NUS Corporation directed this experiment in an effort to learn how viruses incorporated in the chromatin material of certain bacteria are produced in the weightless state, with and without the influence of radiation.

The viruses serve as pieces of genetic information in the chromosome and multiply rapidly under radiation, bursting the parent cell in the reporduction process.

Biosatellite II was launched from Cape Kennedy about three hours later than planned Sept. 7 at 6:04 p.m. EDT. The spacecraft remained in orbit 44 hours and 54 minutes and was ordered to return to Earth near Hawaii on the 30th orbit. The call-down came 17 orbits earlier than planned.

NASA Control officials decided to return the spacecraft early because of difficulties in getting it to accept ground station commands and because a massive tropical storm was moving into the recovery area. NASA's ATS-I satellite photographs of the storm assisted control personnel in their recovery decision.

Biosatellite scientists noted that early recovery resulted in less risk to the experiments than if recovery had been delayed beyond the planned three days. Despite the delayed launch and early recovery, scientists reported only a small decrease in the expected data return from the experiments.

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